



Assessing the Impact of Differential Operationalization of Rurality on Studies of Educational Performance and Attainment: A Cautionary Example

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Abstract

The lack of consensus among researchers in defining the focal construct of rurality has led to contradictory conclusions of whether or not a rural-urban performance gap exists in higher education. Compounding this problem are the changing definitions of *rural* and *urban*, even among governmental agencies. Thus, this study used two different definitional models of rurality to illustrate how different definitions can result in contradictory interpretations of any observed performance and attainment gap between students from different backgrounds.

Introduction

Historically, residents of rural areas have lagged behind their urban area counterparts in terms of educational attainment. Whitner and McGranahan (2003) reported that only 17% of rural adults age 25 and older had college degrees in 2000, whereas the percentage of urban adults with degrees was twice that number (34%). A number of studies

have attempted to explain this gap in educational attainment, but have failed to come to a consensus on the subject. In fact, in research published in 1998, Gibbs, Swaim, and Teixeira (Eds.) argue that a rural-urban skills gap and low educational quality in rural schools are simply myths based on anecdotal and fragmentary data. The incongruity in research regarding the existence of a rural-urban gap in higher education, specifically at four-year colleges, must be resolved for postsecondary institutions to understand the effects of geographic background on student success.

A review of the literature reveals that a potential cause for the divergent findings in the educational achievement and attainment of students from rural backgrounds versus those from urban backgrounds is methodological. Specifically, there is no uniformity in the literature in how rurality is operationalized. For instance, qualitative studies on the rural-urban education gap have relied on either self-reports from individuals or arbitrary classifications by

the researchers to identify the rural student (e.g., Whiting, 1999). Quantitative studies tend to rely more on established rural classifications such as designations by the U.S. Census Bureau or the Office of Management and Budget (e.g., Blackwell & McLaughlin, 1999; Gibbs, 1998; Yan, 2002); however, the cut-points for delineating between rural and urban vary by study. Further complicating this scenario are fundamental changes in the underlying data used to identify rurality. For instance, the basic population thresholds used for delineating between urban and rural areas for the U.S. Census have been adjusted as recently as the year 2000. In addition, many small towns today have adjoining small towns that, it can be argued, combine to create an urban area. To recognize this trend, the U.S. Census Bureau revised its categorization guidelines after the 2000 census to classify these clusters of small towns as urban. Under the previous guidelines, the rural population would have increased by approximately 2 million over the 1990 census figure; however, with the 2000 definition changes, America's rural population declined by 3 million according to the Economic Research Service of the U.S. Department of Agriculture (ERS, 2003b).

The lack of consensus in the literature regarding the definition of rurality has contributed to the contradictory picture of whether or not a rural-urban gap exists in higher education; however, the salience of the

issue remains. Higher education has become a key factor in establishing economic security and achieving social mobility as the baccalaureate has become a requirement, rather than a preference, for many entry-level professions (Pascarella & Terenzini, 1991). Yet regardless of the value of the baccalaureate, the National Center for Education Statistics estimates that 16% of first-time undergraduates in public four-year institutions leave during their first year of enrollment and, of these students, 36% never return to postsecondary education (Horn & Carroll, 1998). Despite the personal, social, and economic value of a college education, Vincent Tinto (1993) notes "more students leave their college or university prior to degree completion than stay" (p. 1).

Considering these statistics, it is understandable how measures of student success such as retention rates have become key factors in the public evaluation of four-year colleges and universities. This public awareness of retention rates, coupled with fundamental institutional commitments to facilitate student success have resulted in the emergence of retention as a key concern for higher education institutions, leading numerous institutions to initiate programs designed to meet the needs of students at-risk of withdrawal prior to graduation (Lang, 2001–2002).

Reliable identification of students at-risk of withdrawal is a key factor in developing targeted, efficient intervention programs. The students most

at-risk for staying out of higher education have the greatest need for academic and social support networks designed to facilitate their successful integration into the institution's academic and social culture. Given the anecdotal evidence of a performance gap between rural and urban students in higher education and the contradictions evident in the existing literature on this issue, further study on the impact of rurality on student educational attainment is imperative.

A primary goal of the present research is to highlight the importance of how rurality is defined for interpretive purposes. This study will operationalize rurality in two different ways to illustrate how different definitions of the rural-urban construct can result in different interpretations of student performance and attainment between rural and urban students. This variation in results by rurality definition also serves as a cautionary example for researchers investigating other phenomena that do not have a widely accepted operational definition. Further, the results of this study will begin to clarify whether a rural background does indeed function as a disadvantage for students in their pursuit of higher education.

Literature Review

A Comparison of Rural and Urban Postsecondary Achievement and Attainment

Work by a number of researchers over several



decades of study supports the existence of a gap between rural and urban students in postsecondary educational achievement and attainment; however, the comparability of these findings is compromised by the varied definitions of rurality the researchers employed. Feller (1974) reported that top achievers tended to be urban, non-middle class, and female, whereas the lowest achievers were rural, middle-class, and male. Unfortunately, the author provides little detail about the designation of rural or urban, merely stating that students were either from an "urban background" or from a "rural-small town" background.

Similarly, Aylesworth and Bloom (1976) found that the attrition rate for rural students attending a large state university was significantly higher than that of urban students. They argue that their results demonstrated that rural freshman were intellectually comparable to urban freshman and any discrepancy in attainment is likely attributable to institutional factors. In this study, rurality or urbanity was self-reported by the survey respondents.

According to Gibbs (1998) the average years of schooling for rural and urban adults is converging, but the proportion of rural adults with college degrees grew much more slowly than the proportion of urban adults. He identifies the major cause of this disparity as a lack of opportunity. He argues that rural students experience more difficulty both in getting to college and in

reaping the benefits of a college education when they return home. Both rural and urban young adults have a similar likelihood of graduating from high school or obtaining a GED, but only 56% of rural youth attend college compared to 65% of urban youth. In an analysis of conditional probabilities, Gibbs (1998) found that college attrition rates were not the roadblock to degree completion for rural students; instead it was that rural students were less likely to attend college at all. Gibbs' research was based on the National Longitudinal Survey of Youth (NLSY) which recorded the respondents' state and county of residence. From this information, the Center for Human Resource Research (the organization responsible for the NLSY) was able to determine whether the respondent was from a rural or urban environment based on the *City and County Data Books* published by the U.S. Census Bureau. Though Gibbs' research is based on quantitative data, the rationale or rubric for designation of rural or urban was not clearly reported.

While Gibbs argues that there is a gap between rural and urban educational attainment, the volume in which he makes this claim (Gibbs, Swaim, & Teixeira, Eds., 1998) ultimately concludes that the claims of a rural skill gap are largely unfounded. Echoing the findings of Aylesworth and Bloom (1976), Gibbs et al. (1998) propose that while rural high schools have fewer resources, they operate more efficiently and offer their students an education

comparable to that received by urban students. Thus, rural students can begin their postsecondary studies on a level playing field with urban students in regard to their academic achievement. The discrepancy, therefore, lies in the degree to which rural students capitalize on the opportunity to earn postsecondary degrees.

Blackwell and McLaughlin (1999) investigated factors that may influence the educational attainment of both rural and urban students in order to determine the true variance between the two populations. Using data from the National Longitudinal Survey of Youth (NLSY), they examined family, school, and community factors that influence educational attainment. After adjusting for these factors, their results show that rural youth eventually attained similar levels of education as urban youth with the same characteristics. By using NLSY data, Blackwell and McLaughlin employ the same operationalization as Gibbs' work using the NLSY.

Geographic Considerations

The body of research exploring a rural-urban gap in academic achievement and attainment has spanned almost three decades, which necessitates a consideration of demographic trends. Within this time period, the United States has experienced a population shift that has begun to blur the lines between rural and urban areas. Rural counties, which had population losses in the 1980s, experienced significant

population gains in the 1990s (McArdle, 1999). Between the years of 1990 and 2000, the total nonmetropolitan population grew by 10%, and some rural areas in the West grew by as much as 20% (Whitner & McGranahan, 2003). Much of this growth can be attributed to the urban sprawl around large metropolitan areas, which has resulted in rural towns becoming a part of commuter zones. These population shifts that have created "suburbia" are changing the face of rural America, which should make accurately defining rurality a primary concern for researchers.

Due to these population shifts, the U.S. Census Bureau and the Office of Management and Budget adjusted the way in which they defined rural and nonmetropolitan areas in the year 2000. The new definition of rural and urban areas creates an impetus for additional research

regarding differences in college achievement between students from varying backgrounds. In the present study, rural and urban students will be identified based on a current and well-defined classification system with the expectation of resolving the contradictory findings that exist regarding the rural-urban gap in higher education.

Methodology

Study Population

The population for this study is drawn from the 1997 through 2000 new freshmen cohorts at NC State University. NC State is a public, land grant, doctoral research institution located in Raleigh, North Carolina. The institution focuses heavily on science, technology, and engineering with historical strengths in programs for which it is the unique provider in the state (e.g., agriculture, textiles,

and veterinary medicine). In Fall 2004, NC State enrolled a total of 29,957 students, 76% of which were undergraduates (N=22,754). Freshman one-year retention for the most recent cohort (2003) stands at 90.9%. The four cohorts studied in this project were comprised of 11,004 students and were followed through Spring 2004. For this study, international students were excluded due to the difficulty in determining their geographic affiliation.

Variables

The rural-urban status variable was determined through the use of Rural-Urban Continuum Codes (RUCC) (ERS, 2003c), a paradigm developed by ERS, which classifies all U.S. counties by their degree of rurality using a 9-point scale as displayed in Table 1 (ERS, 2003a). The county and population breakdown for the

Table 1
Rural-Urban Continuum Codes (RUCC)

RUCC	Location Type	Location Class	Population	Metropolitan Location
1	Metropolitan	Urban	1 Million +	--
2	Metropolitan	Urban	250,000–1 Million	--
3	Metropolitan	Urban	Less than 250,000	--
4	Nonmetropolitan	Urban	20,000 or more	Adjacent
5	Nonmetropolitan	Urban	20,000 or more	Not Adjacent
6	Nonmetropolitan	Urban	2,500–19,999	Adjacent
7	Nonmetropolitan	Urban	2,500–19,999	Not Adjacent
8	Nonmetropolitan	Rural	Less than 2,500	Adjacent
9	Nonmetropolitan	Rural	Less than 2,500	Not Adjacent

Note: Adapted from ERS (2003a). Measuring rurality: Overview.
<http://www.ers.usda.gov/briefing/rurality/overview.htm>.



RUCC are shown in Table 2 (ERS, 2004). For this sample, each student's home address zip code provided on his or her university application was used to classify students according to the RUCC

taxonomy. This zip code was matched with the corresponding Federal Information Processing Standard (FIPS) code, which was subsequently matched with the appropriate RUCC.

To explore the impact of different definitional models for rural and urban designation, two different definitions of each term were explored (see Table 3). For the Classification definitional

Table 2

Rural-Urban Continuum Codes (RUCC) by Number of Counties and Population in the United States.

RUCC	Number of Counties	2000 Population
Metro Counties:		
1	413	149,224,067
2	325	55,514,159
3	351	27,841,714
Nonmetro Counties:		
4	218	14,442,161
5	105	5,573,273
6	639	15,134,357
7	450	8,463,700
8	235	2,425,743
9	435	2,802,732
U.S. Total:	3,141	281,421,906

Note: Adapted from ERS (2004). Measuring rurality: Rural-urban continuum codes. <http://www.ers.usda.gov/briefing/rurality/RuralUrbCon/>.

Table 3

Rural-Urban Model Definitions

Rural-Urban Model	Rural/Urban	RUCC	Metropolitan Designation	Location Class	Population	Metropolitan Location
Classification	Rural	8, 9	Nonmetro	Rural	Less than 2,500	Adjacent, Not Adjacent
	Urban	1, 2, 3, 4, 5, 6, 7	Metro, Nonmetro	Urban	More than 2,500	Adjacent, Not Adjacent
Population	Rural	6, 7, 8, 9	Metro Nonmetro	Rural, Urban	Less than 20,000	Adjacent, Not Adjacent
	Urban	1, 2, 3, 4, 5	Metro Nonmetro	Urban	More than 20,000	Adjacent, Not Adjacent

Note: Elements in bold indicate the distinguishing characteristics of the models.

model, rural and urban distinctions are made according to the RUCC designation of rural or urban. Under this definition, *rural* describes locations with less than 2,500 people and *urban* refers to areas with more than 2,500 people. Alternatively, the Population definitional model relies on a more relaxed population threshold where *rural* is defined as less than 20,000 people and *urban* has more than 20,000 in a census area.

Secondary education performance measures included in this analysis were high school GPA and total SAT score. Postsecondary performance and attainment variables used in this study include enrollment status when last enrolled and cumulative GPA when last enrolled. Enrollment status consisted of four categories: enrolled, graduated, suspended, and withdrawn. A simplified version of enrollment status

was created where enrolled and graduated were combined to form a category called Persistence while suspended and withdrawn were combined to form the Nonpersistence category. In addition, ethnic and gender variables were included in this analysis. Table 4 presents a summary of these variables.

Analysis

After descriptively analyzing the study variables, t-tests were

Table 4
Independent Variables

Variable	Variable Name	Definition
Persistence	PERSIST	1=Yes 0=No
Total SAT	SATT	Continuous, 400–1600
Cumulative GPA	CUMGPA	Continuous, 0.00–4.00
Weighted High School GPA	HSGPA	Continuous, 0.00–5.00
Gender	SEX	F=Female M=Male
Race	ETHNIC	W=White AA=African American NA=Native American A=Asian H=Hispanic

conducted for the continuous variables to determine if there was a statistically significant difference between rural and urban students with respect to the study variables. Where a significant effect was found, Cohen's d was calculated to determine the size of the effect. For the categorical variables, either chi-square or Fisher's Exact Test analyses were performed to determine whether there was a statistically significant relationship between the variables. Fisher's Exact Test is appropriate when both categorical variables are dichotomous while chi-square is appropriate when at least one categorical variable is polytomous. Effect size for chi-square analyses was determined through the Cramer's V statistic. The Phi coefficient, computed as a Pearson correlation, was used in estimating effect size for the Fisher's Exact Test. At most, the value of Phi ranges from -1 to 1, though its actual range is reduced if the observations are not equally distributed across the two dichotomies of the classification variable. The Cramer's V , computed from the chi-square, functions very much like a correlation coefficient. Values range from 0 to 1.0 with the strongest associations represented by values close to 1.0. When the marginal distributions of the two measures are not identical, the maximum value of Cramer's V is -1.

Limitations

The study assumed that the student's home address at the time of application to NC State is reflective of the environment

in which the student grew up. To the extent that students move from one area to another area of a different rural-urban classification is not captured by this data and could introduce some bias into the results. In addition, it is important to note that this study is of students at a single institution that is historically focused on science, engineering, and technology—disciplines which have traditionally attracted more white men and fewer minorities and women. Further research

is encouraged at other types of institutions to explore whether there is an effect related to the institutional type. Finally, this study looks only at students who attended the study institution for at least one semester. Students who were denied admission and those who did not apply to the study institution are outside the scope of this study.

Results

This analysis explored the academic performance and

Table 5

Rural-Urban Model Descriptive Statistics for Dependent Variable

Variable	Variable Value	N	%
Classification Model	Rural	263	2.39
	Urban	10,741	97.61
Population Model	Rural	1,038	9.43
	Urban	9,966	90.57

Table 6

Descriptive Statistics for Categorical Independent Variables

Variable	Variable Value	N	%
PERSIST	Y	7,985	72.56
	N	3,019	27.44
	W	9,036	82.12
ETHNIC	AA	1,187	10.75
	NA	103	0.91
	S	526	4.66
	H	193	1.71
SEX	F	4,675	41.42
	M	6,611	58.58

Table 7
Rural-Urban Model Descriptive Statistics for Continuous Variables

Variable	N	Mean	SD
CUMGPA	10,960	2.78	0.82
HSGPA	10,627	3.87	0.46
SATT	11,004	1229.9	244.07

attainment of rural and urban college students to determine whether there were significant differences between these two groups with respect to a variety of performance and attainment measures. This comparison took into account two different definitions of rurality to illustrate how different operationalizations result in differing interpretations. The trends in student performance and attainment

that emerged from the various operationalizations of rurality will begin to clarify whether a rural background disadvantages certain students in their pursuit of higher education.

Using the Classification definition, which is a more rigorous definition of rural, rural students accounted for 2.39% of the study population. According to the more relaxed Population model, rural students

comprised 9.43% of the study population (see Table 5). Tables 6 and 7 summarize the overall sample population parameters. Descriptively, the data indicated that 27.44% of the study population ultimately did not persist. Ethnically, the study population was largely White (82.12%) with African Americans comprising the largest minority group (10.75%). Males outnumbered females 58.6% to

Table 8
Rural-Urban Model Analysis for Categorical Variables

Rural-Urban Model	Variable	Test	Test Statistic	p-Value	Effect Size Measure	Effect Size Statistic	Effect Size
Classification	PERSIST	Fisher's	--	0.1836	--	--	--
	ETHNIC	X2	11.1768	0.0246	Cramer's V	0.0319	Small
	SEX	Fisher's	--	0.0035	Phi	-0.0280	Small
Population	PERSIST	Fisher's	--	0.0031	Phi	0.0287	Small
	ETHNIC	X2	31.2356	0.0001	Cramer's V	0.0533	Small
	SEX	Fisher's	--	0.0023	Phi	-0.0291	Small

Notes: Bold indicates significance at the 0.05 _-level
Effect size determination is based on classifications from Cohen (1988)

**Table 9*****Rural-Urban Model Analysis for Continuous Variables***

Rural-Urban Model	Variable	Rural Mean	Urban Mean	t	p-Value	Cohen's d	Effect Size
Classification	CUMGPA	2.65	2.79	-2.45	0.0150	-0.16124	Small
	HSGPA	3.91	3.87	2.30	0.0222	0.12422	Small
	SATT	1145.6	1175.2	-3.30	0.0010	-0.22858	Small
Population	CUMGPA	2.67	2.80	-4.63	0.0001	-0.15578	Small
	HSGPA	3.94	3.86	5.64	0.0001	0.179115	Small
	SATT	1147.7	1177.1	-6.64	0.0001	-0.22356	Small

Note: Bold indicates significance at the 0.05 _-level

Effect size determination is based on classifications from Cohen (1988)

Table 10***Summary of Variable Significance and Effect Size by Rural-Urban Model***

Variable	Rural-Urban Model	
	Classification	Population
PERSIST	NS	S
ETHNIC	S	S
SEX	S	S
CUMGPA	S	S
HSGPA	S	S
SATT	S	S

Note: S indicates small effect. NS indicates the variable was not found to show a significant difference between rural and urban students.

41.4%. The study population had a mean weighted high school GPA of 3.87 and an average SAT total score of 1229.9. Once at NC State, the study population posted a mean cumulative GPA of 2.78.

Tables 8 and 9 present the results of the t-test, chi-square, and Fisher's Exact Test analyses. Each independent variable was tested for significance between rural and urban students for the two definitional models of rural and urban. Under the Classification definition, small significant effects were observed for ethnicity, gender, cumulative GPA, and high school GPA. A small significant effect was also observed for total SAT. The Population definition found significant small effects for persistence, enrollment status, ethnicity, gender, cumulative GPA, high school GPA, and total SAT score. Table 10 summarizes these findings.

Discussion

This study explored the impact of various definitions of rurality on differential attainment and performance of undergraduate students. Using the RUCC, this study operationalized rurality in two different ways. First, the Classification model used the RUCC typology to delineate between rural and urban, with rural defined as an area with a population of 2,500 or less and urban as an area with a population greater than 2,500. A second definition used a broader population threshold where rural was defined as an

area with a population of less than 20,000 and urban as an area with a population of 20,000 or more. Because the definition of rurality varies considerably in the literature on student performance and educational attainment, this study sought to explore how, using the same population, different results could be achieved given different definitions of rurality and urbanity.

The results do show significant difference for gender between the two definitions of rurality, and in each model, this effect was determined to be relatively small. Given that these two variables show significance regardless of the rural definition, it is reasonable to conclude that there is a substantive discrepancy between rural and urban students with respect to gender. Under both definitions of rurality, the percentage of females from rural areas is significantly smaller than the percentage of females from urban areas. This supports other research on rural issues that finds rural women are disadvantaged in their pursuit of higher education (e.g., O'Quinn, 1999; Grant, Heggoy, & Battle, 1995).

Key to this disadvantage for rural women are the strong community and family structures typically prevalent in rural areas. In these cultural frames, the traditional role for women is to maintain the home and raise children. In this environment, girls are socialized early in life to maintain this role as they grow up (Beaver, 1986), and from this perspective, educational pursuits are viewed as unnecessary to

fulfilling the culturally accepted roles of wife and mother. Though the economic and cultural profiles of rural areas have changed in recent years (O'Quinn, 1999), women from these regions still face difficulty viewing education as attainable. O'Quinn has shown that, despite their participation in higher education, these rural women experience a significant internal conflict regarding their integration into the college culture as well as difficulty in relating to their families. Indeed, this finding suggests that higher education places rural women in a compromised social position, where they neither fit comfortably in their academic community nor in their family community. Thus, it is little wonder that higher education participation by rural women is significantly below that of urban women. Therefore, interventions are critically necessary to facilitate rural women's integration into the academic community as well as to assist these women in transitioning between their academic and family communities.

Just as gender was significant for both definitions of rurality, so too was cumulative GPA with significantly higher means for those from urban backgrounds than those from rural backgrounds. Unfortunately, this study reveals that the performance gap observed by Feller in 1974 still exists. Given the consistency of this result across both definitions of rurality and three decades of economic change, as well as efforts by educators and

other professionals to address the performance gap between rural and urban students, the effect appears to be a highly resilient cultural phenomenon that deserves increased attention by social scientists, educational practitioners, and policy makers.

Total SAT score also showed a small significant effect for both the Classification and Population definitions. For each of these definitions, urban students' average SAT scores were significantly higher than the scores of their rural counterparts. While the SAT has been shown to demonstrate gender, cultural, ethnic, and socioeconomic biases (e.g, Freedle, 2003; Young & Fisler, 2000), the results from this study demonstrate the bias in the SAT can be described as geographic as well. However, because ethnic, socioeconomic, and cultural factors often govern where people live, geography may be functioning as a proxy for these variables and further research is needed to tease out the individual effects of each of these sociodemographic factors.

Significant small effects were also observed under both the Classification and Population definitions of rurality for ethnicity and high school GPA, while persistence was significant for only the Population definition. A review of the literature revealed considerable contradictions regarding the educational performance and attainment of rural and urban students, yet each study operationalized rurality and urbanity differently making it impossible to gain a clear understanding of this

phenomenon. To explore this situation, this study investigated the differential educational performance and attainment of rural and urban students for two different definitions of rurality. The findings demonstrate that the operationalization of rurality and urbanity does have an impact on the outcome of the analysis.

The results of this study reveal an important point. Regardless of which definition is used, the same results are found (i.e., a significant difference between rural and urban students) for ethnicity, sex, cumulative GPA, high school GPA, and total SAT. Yet, with respect to Persistence, whether a student dropped out or continued enrollment, the results under the two definitional models were different. Persistence is the ultimate measure of attainment since if students do not persist until graduation; they cannot reap the socioeconomic benefits of the baccalaureate.

Higher education professionals who are seeking to design interventions strategies to improve their institutional retention rates typically focus on specific at-risk populations and, for information on these groups, the retention literature is an important resource. Thus, it is imperative that higher education professionals recognize how the variance in the operationalization of rurality impacts the findings in the literature. Depending on how rurality is operationalized, different conclusions can result, and these differences can impact how institutions design their

retention intervention programs. Under the broader Population definition of rurality, this study found a significant difference between rural and urban students with respect to persistence. The effect of this difference is of a similar magnitude as that observed for other variables commonly targeted by retention improvement programs such as ethnicity and gender. Thus, to exclude geographic background as an at-risk factor, while focusing on other variables, potentially limits the effectiveness of these intervention programs. Therefore, it is vital that researchers of this problem identify and utilize a common definition of rurality and urbanity, which will promote progress in understanding this issue and in developing effective retention programs.

The findings of this study are far from unique in that there are numerous phenomena that lack an operational consensus in the scholarly community. By demonstrating how interpretations of data can vary across different definitions of rurality, this study serves as a cautionary example. It is vital that, at a minimum, researchers clearly articulate the parameters of their variable definitions and present their rationalizations for these decisions. Where possible, scholarly communities must carefully vet concepts to achieve an operational consensus for key variables. This practice will, in turn, allow research to advance our understanding of these phenomena.

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